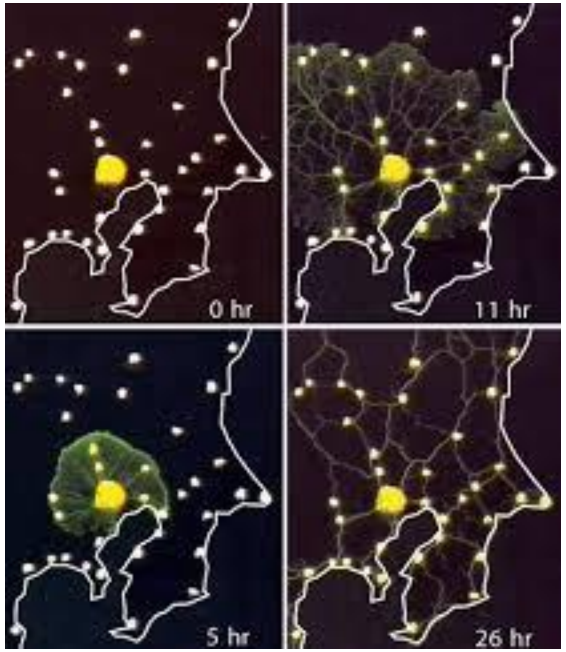
data cyborgs

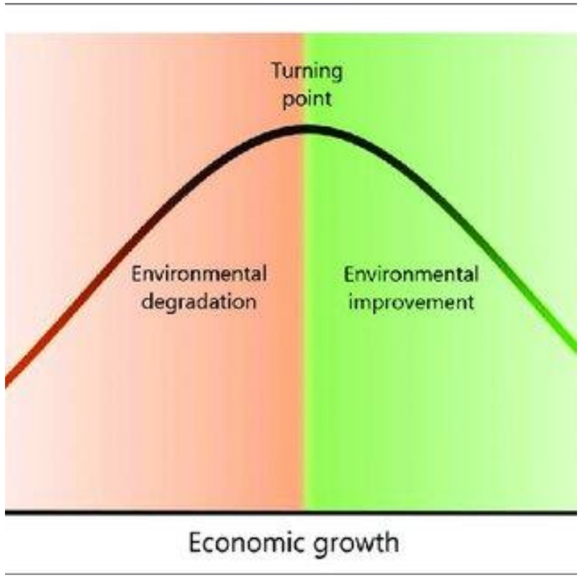
Constructing Datafied Relations, Week 5

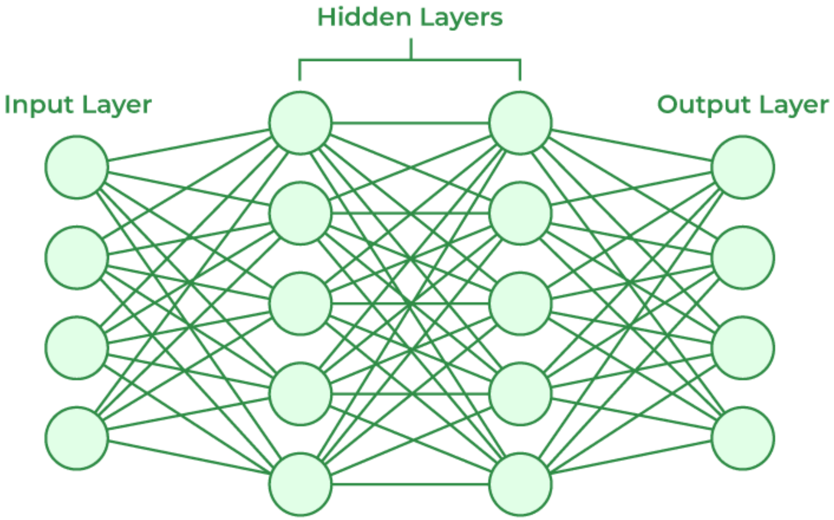
1) Models and the Model Cyborg

What are models?

- Representations or systems the humans use to understand and interact with the world.

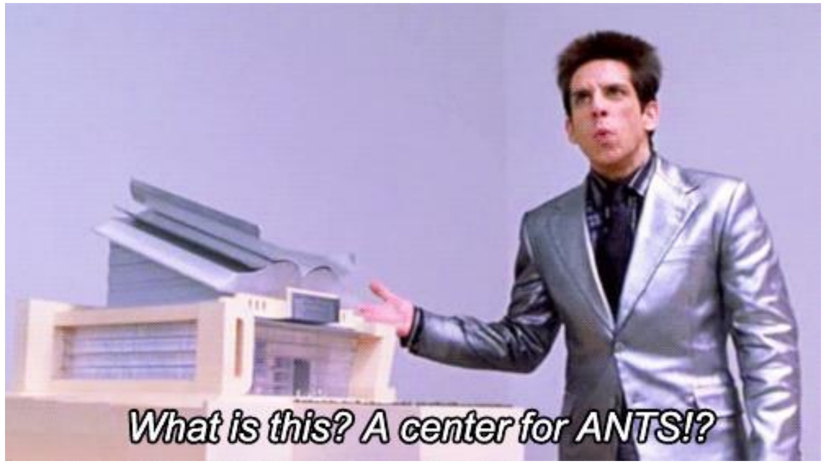






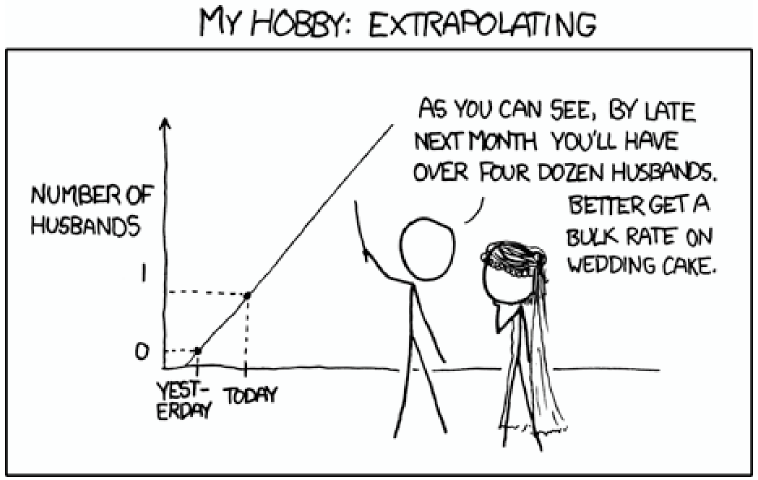
Properties of Models

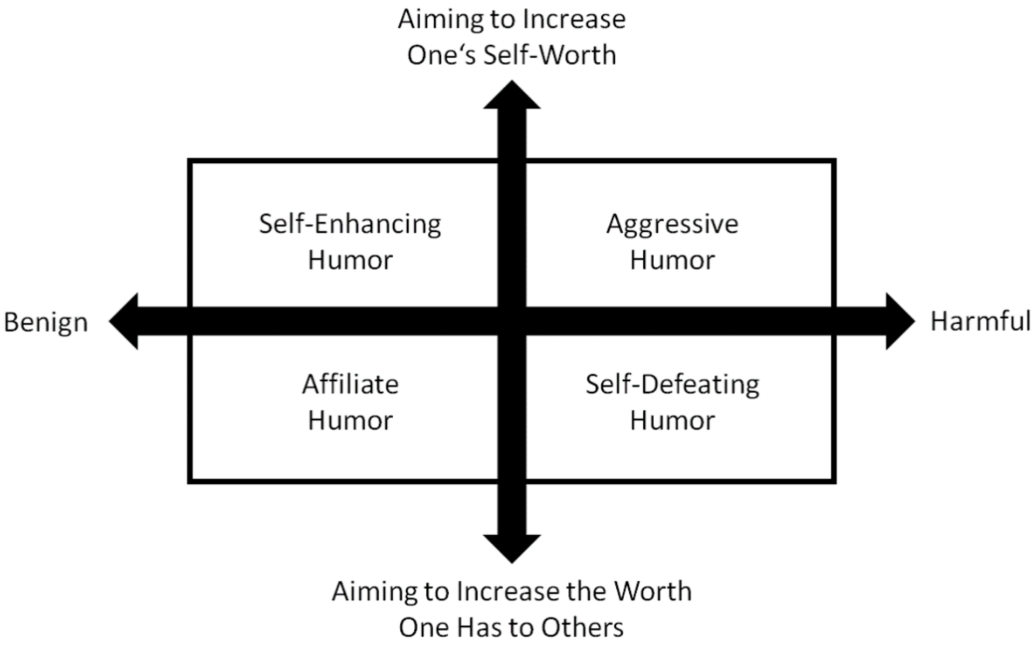
- *Mapping* – Representation of some natural, artificial, existing or imagined original.
  - E.g., Health of economy = GDP
- *Reduction* – Will only include attributes that appear relevant to creator/user.
  - E.g., Only transactions
- *Pragmatism* – Does not relate unambiguously to original. Intended to work as replacement.*
  - For certain subjects*
  - Within a certain time range*
  - Restricted to certain conceptual or physical actions*
    - GDP originally measured some aspects of economy, correlated well with other desirable conditions.
    - Became target for optimization and government policy.



Uses of Models

- Prediction (interpolation/extrapolation)
- Explanation
- Theoretical Exposition (discovering/proposing/refuting hypotheses)
- Description
- Illustration



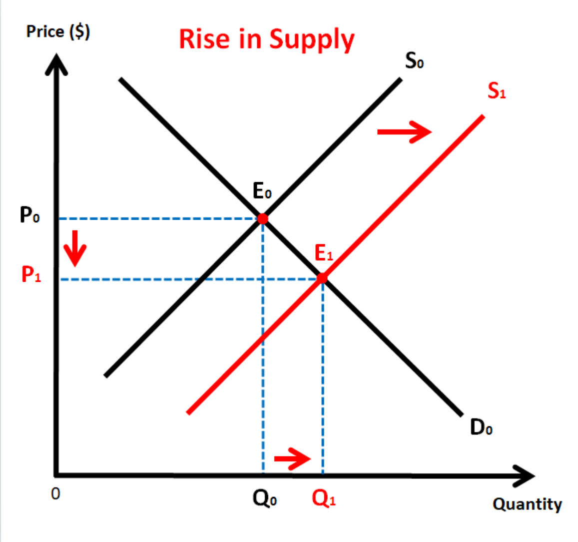


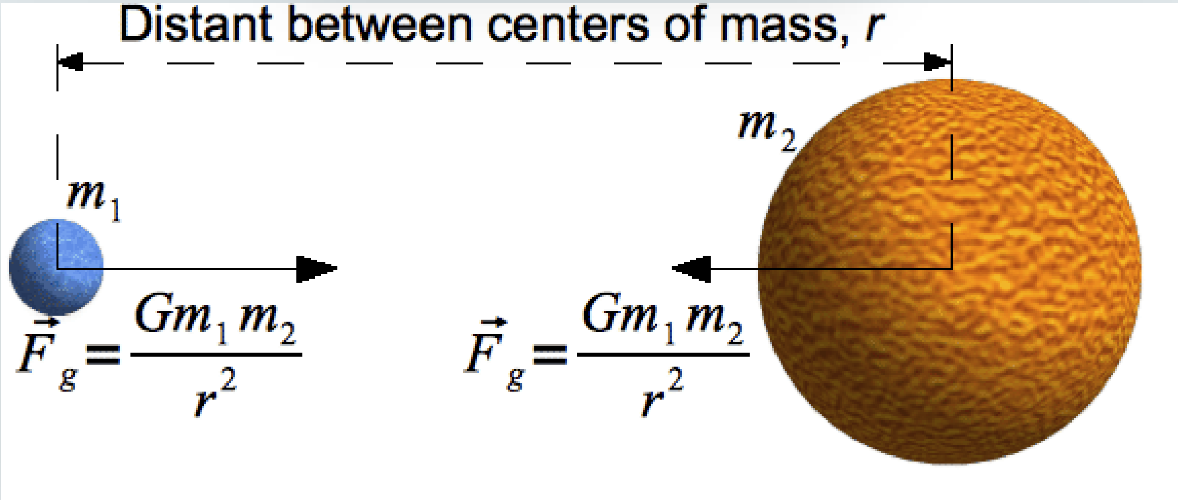
Conceptual Models

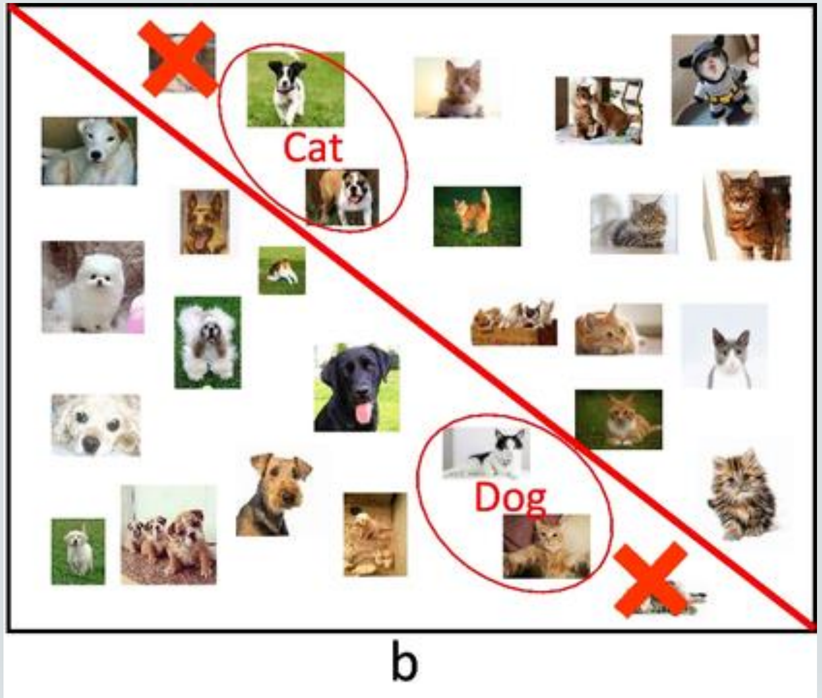
Theoretical Representations of Systems

Conceptual Models – Mathematical/Computational Models

Equations describing an agreed representation of entities and their relationships

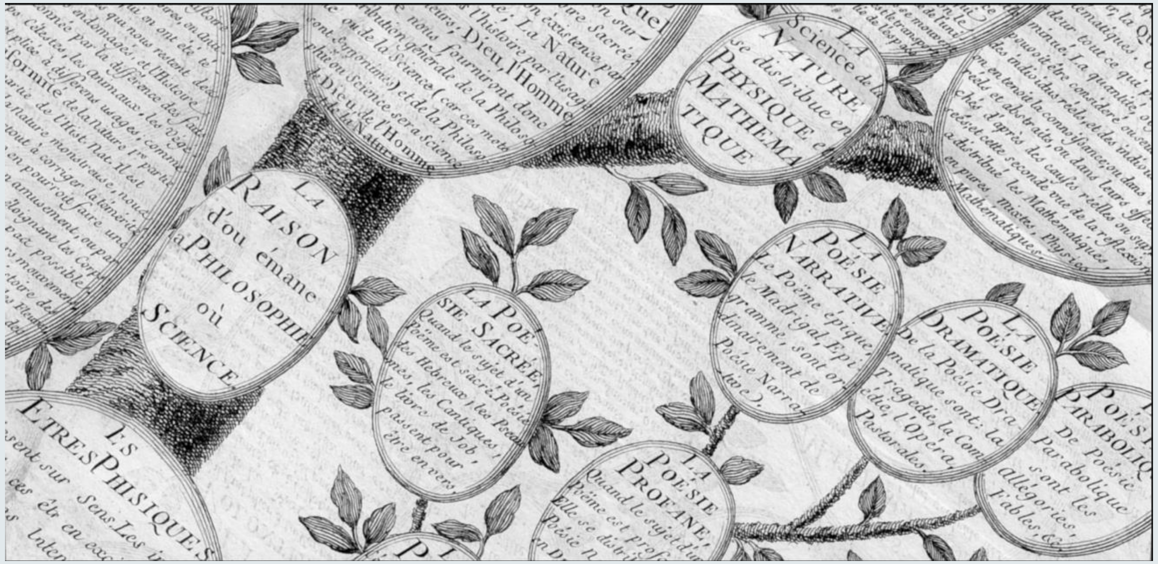


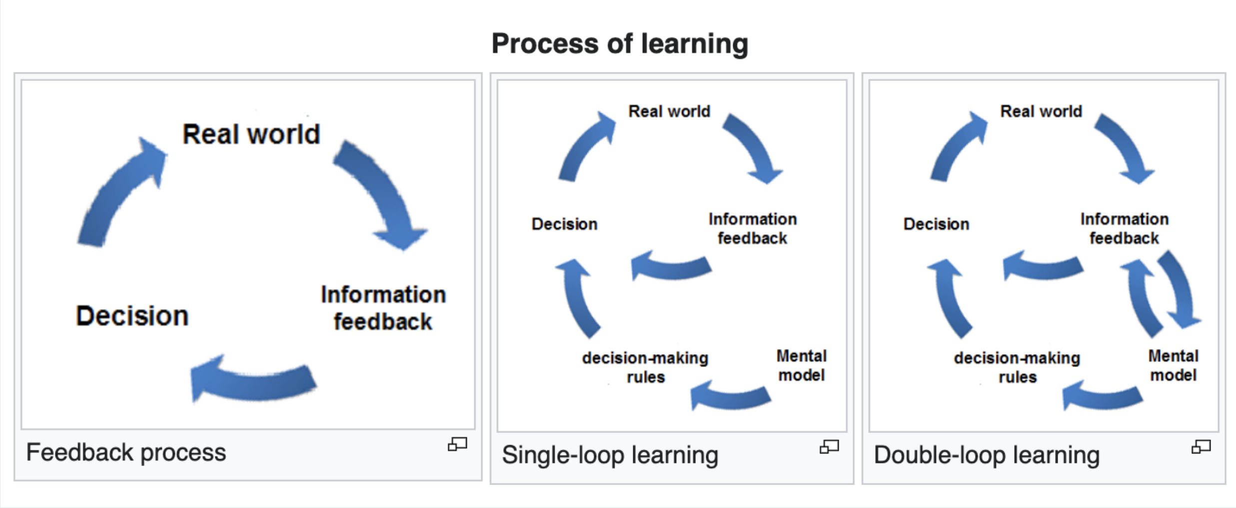




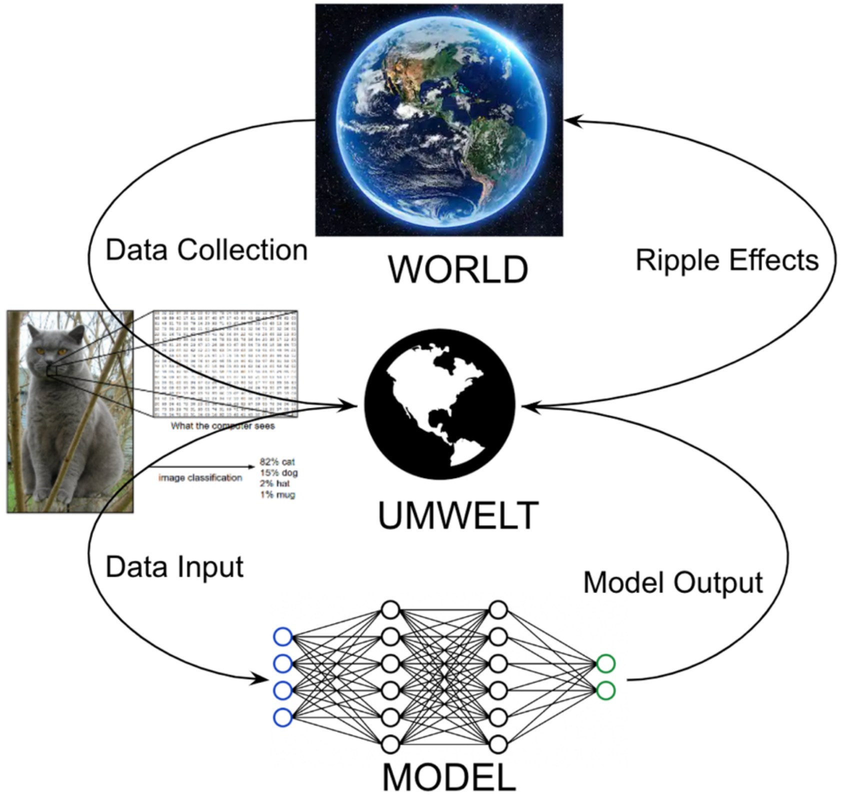
Conceptual Models – Mental Models

Internal representations of external reality – Cognition, Reasoning and Decision-Making



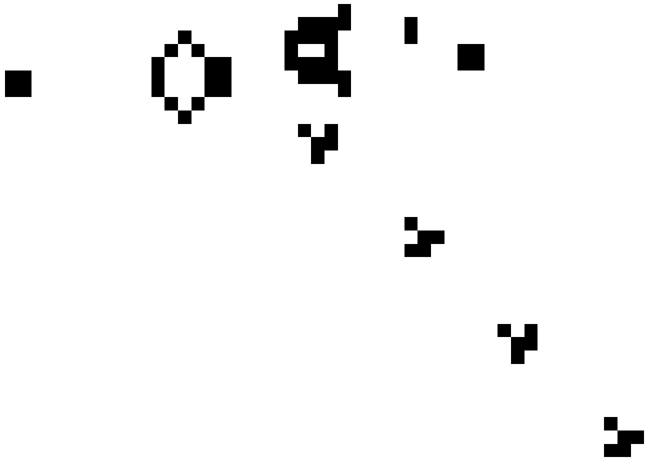


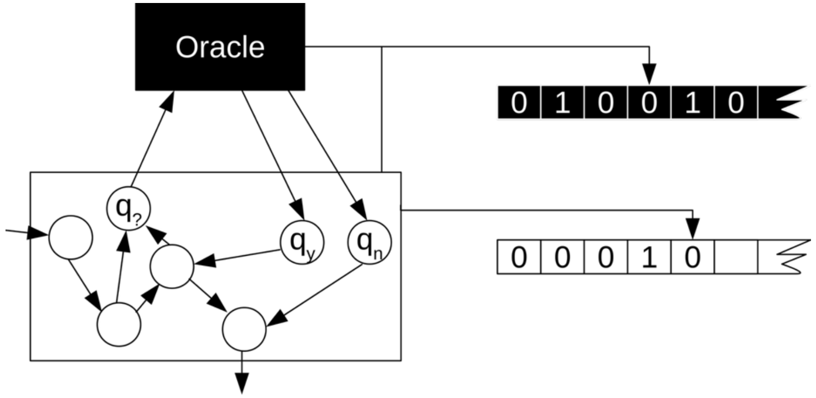
Model Umwelt



Problems with Computational Models

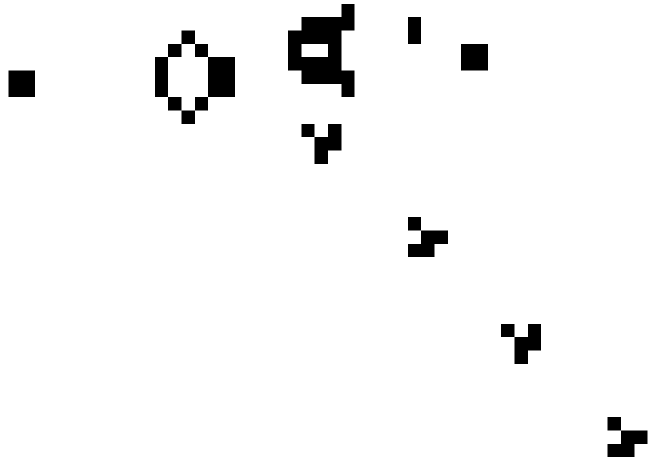
- Can only see/process what is *computable* in the world. Reduce the world into what can be solved algorithmically.
- Some problems (e.g., Conway's game of life) are provably *incomputable*.
- Other systems (weather, ecosystems, behavior) are likely incomputable or practically unsolvable (chaos,complexity)

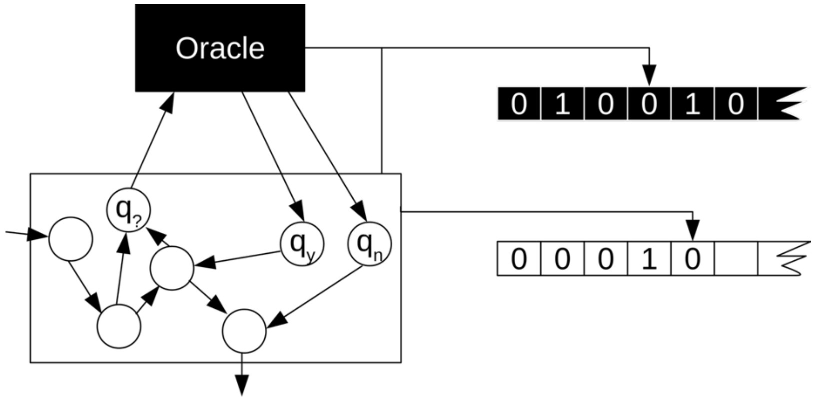


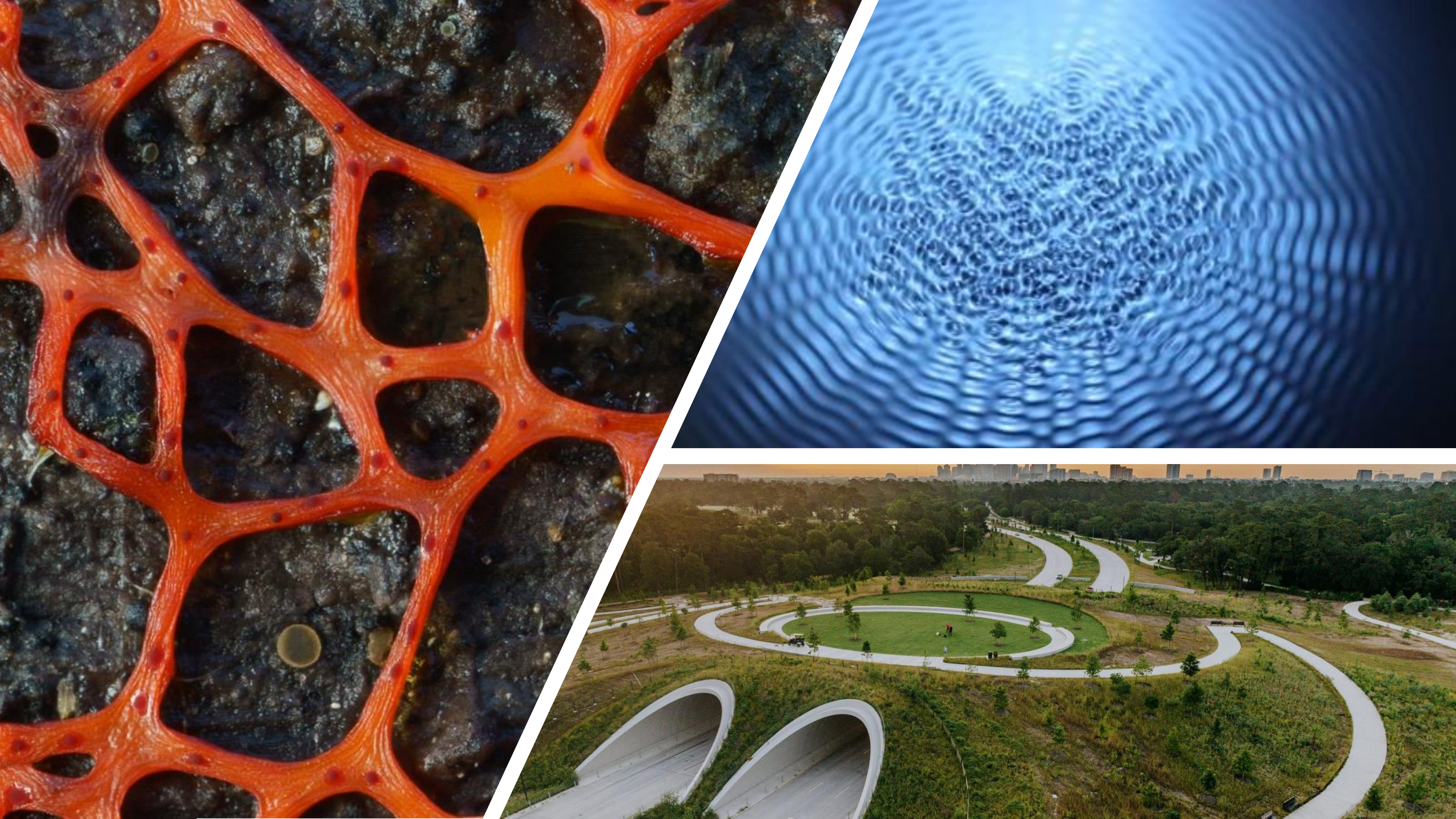


Problems with Computational Models

- *Turing* – The *oracle machine*
  - Computer augmented with an "oracle" that can give answers to incomputable problems.
- *Bridle* – "The world is the oracle."
  - Embodied, unknowable, non-reducible.
  - Beyond computational frameworks
    - V.s. Reducing world to what is computational and making the world conform to computational models.
    - More holistic, adaptive approaches to understanding and interacting with the world.

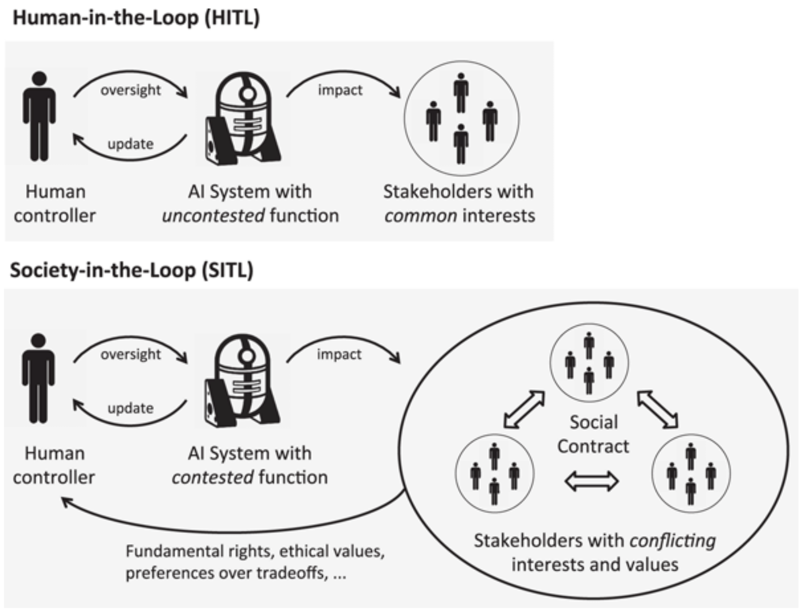


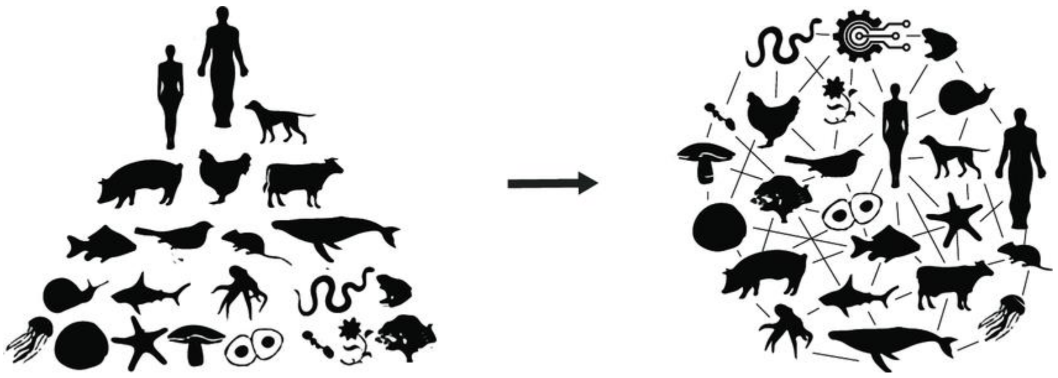




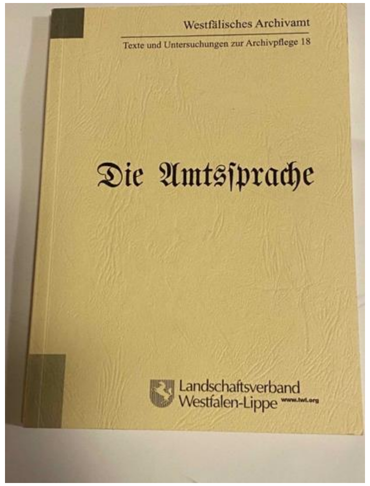
From Model to Model Cyborg

- Models take in data (senses), process through Umwelt (mental model) and reach an output (decision/action).
- Models used by humans for insight, decision-making.
    - Automated
    - Human-in-the-loop
    - Society-in-the-loop
    - More-than-human-in-the-loop
- Actions influenced by model's output determined by whole system of interconnected, entangled Umwelten
    - -> Model Cyborg





Model Cyborg – Model + Data Scientist



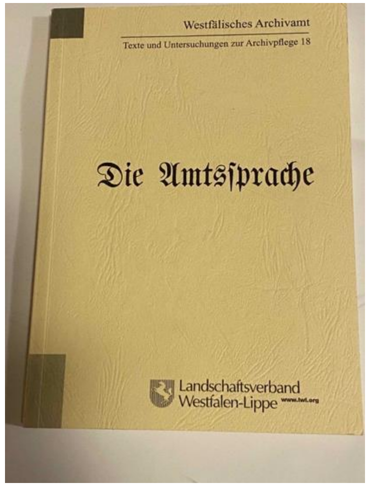
Status Quo

- Only works on tasks that have been reduced to computability stage, or reduces ad-hoc.
- Follows procedure..
  - Ethical choices hidden in language of math and statisitcs.
  - Avoids explicit ethical choices.
- Model in vacuum - Does not consider…
  - Influence of own Umwelt on model.
  - Societal context or ripple effects.
  - Ambiguous translation from world to math.
  - Agency of self or all stakeholders.
  - Model Umwelt is inflexible and imposed on world.

Cyborg EoA

- Is careful and intentional about representation and reduction in data and models.
  - Attentive to what isn't represented.
- Acknowledges that ”no choice is a choice”
  - Procedure = status quo.
  - Deep exploration of ethics dictating model design and possibility of other choices.
- Situated models
  - Investigates how context shapes model
  - Representation of stakeholders and their needs in design process.
  - Accountability for model's effects, design choices.
  - Adapt to changing environment, promote agency.

Model Cyborg – Model + Implementer



Status Quo

- …

Cyborg EoA

- …

How can we use models in a way that recognizes the agency and beyond-computability of the entities it represents/affects?

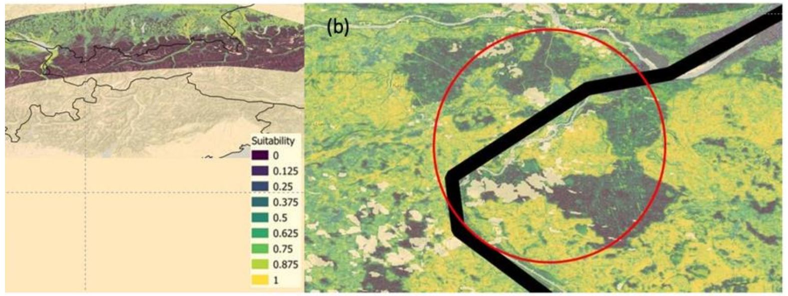
Computational Models in the Case Studies

VFRAME

- Synthetic data – model of real world data
- Deep learning models
    - Illegal munition detection
    - Key (relevant for illegal munition detection) frames from video summary

Waldrapp Project

- Migration routes mapped using tracking data.
- Scientific models to detect abnormalities.
- Classisical ML models
    - Predict habitat foraging suitability.
    - Show trends in migration.
- Fine-tuned, RAG LLMs for bird narratives.



Forest Model for the northern Alpine foothills, according to Wehner et al. (2022); the suitability
d with yellow (=1) for the best foraging habitats. **(b)** Detailed representation of the Burghausen
f the area within a 10 km radius of the breeding site has an index >0.8.

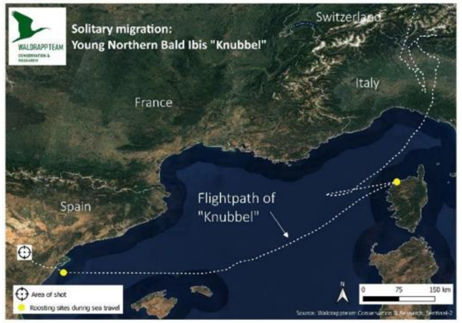
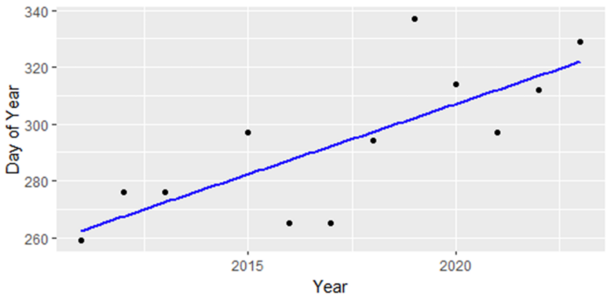


Figure 9 Flight paths of *Knubbel*, after separation from the conspecifics in Northern Italy. Yellow dots mark the two night roosts during the journey. The journey ended in Spain due to illegal hunting.



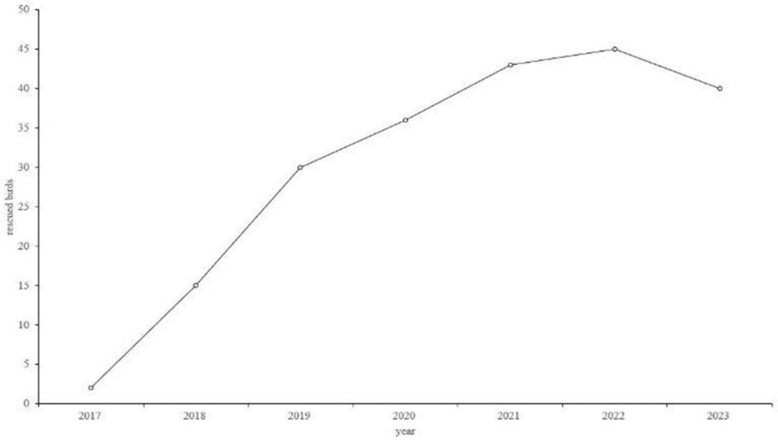
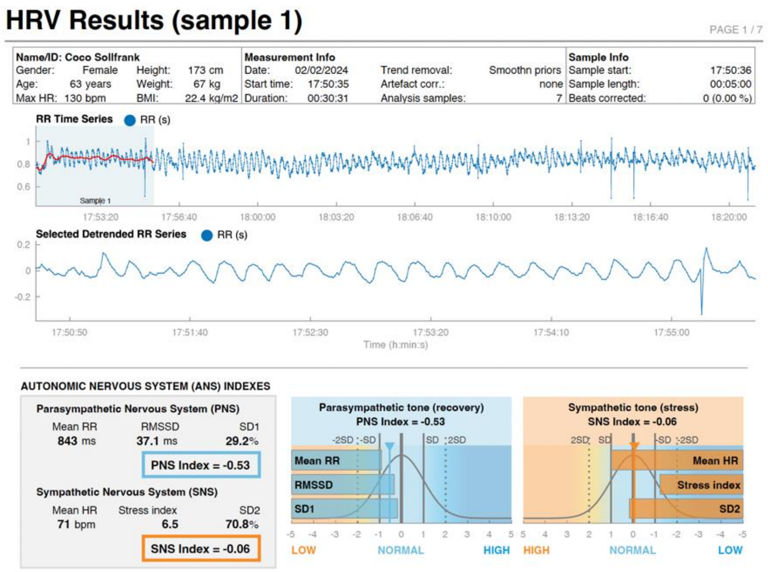


Figure 6 Number of birds that had to be rescued north of the Alps.

Breathing Data

- Various computational models from Oura (e.g., ML for recognizing sleep phases)
- Scientific models for measuring stress/calm levels using *heart rate variability* (HRV)
- Most likely measured against norms in age/gender/size group.



Discussion Questions

- What are some of the mappings and reductions within the case study models?
  - What assumptions are implied?
  - What are some risks/benefits of these framings?
- Who are the intended users? What is the intended use?
  - How does this relate to the chosen mappings/reductions?
  - How could the similar models be misused?
- Viewed as model cyborgs, where is there alignment with authentic freedom? Friction?